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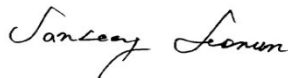TO   :   General

DATE   :   June 21. 2011

SAMSUNG TFT-LCD

MODEL NO : LTN156AT17-W

NOTE : Extension code [-W]
                    → LTN156AT17-W
          Surface type [Anti-Glare]

The information described in this SPEC is preliminary and can be changed without prior notice.

APPROVED BY :

PREPARED BY :   **LCD Application Engineering Group**

SAMSUNG ELECTRONICS CO., LTD.

wise
view™

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REVISION HISTORY

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Date	Revision No.	Page	Summary
June, 21. 2011	A00	All	LTN156AT17-W General model approval spec was issued.

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GENERAL DESCRIPTION

DESCRIPTION

LTN156AT17-W is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight system. The resolution of a 15.6" contains 1366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- 1366 x 768 pixels resolution (16:9)
- Fast Response Time
- Low power consumption
- LED BLU Structure
- DE (Data enable) only mode
- 3.3V LVDS Interface
- On board EDID chip
- RoHS compliance
- PVC free compliance
- BFR free compliance
- As free compliance

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	344.232 (H) x 193.536 (V) (15.6"diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1366 x 768	pixel	16 : 9
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.252 (H) x 0.252 (V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25%, Hardness 3H		Anti-Glare

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	358.8	359.3	359.8	mm	
	Vertical (V)	209.0	209.5	210.0	mm	
	Depth (D)	-	-	5.5	mm	(1)
Weight		-	-	470	g	

Note (1) Measurement condition of outline dimension
. Equipment : Vernier Calipers
. Push Force : 500g ·f (minimum)

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note   (1) Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 °C $\geq$ Ta)
Maximum wet - bulb temperature at 39 ^{O}C or less. (Ta $>$ 40 °C) No condensation

Relative Humidity (%RH)

(40,90)

Operating Range

(50,50.4)

(60,27.7)

Storage Range

Temperature (^{O}C)
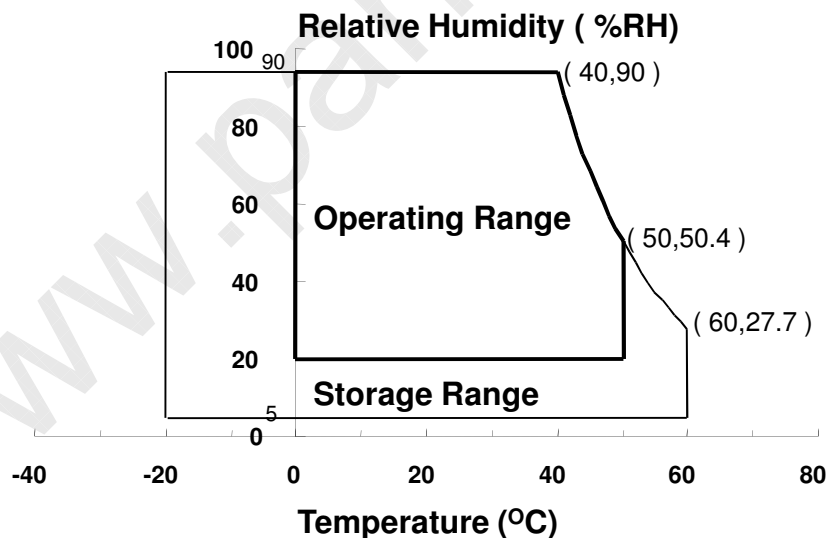
(2) 2ms, half sine wave, one time for $\pm$X, $\pm$Y, $\pm$ Z.
(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be
hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{DD} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)
Logic Input Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)

Note (1) Within Ta (25 ± 2 ℃)

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2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5). Measuring equipment : TOPCON SR-3
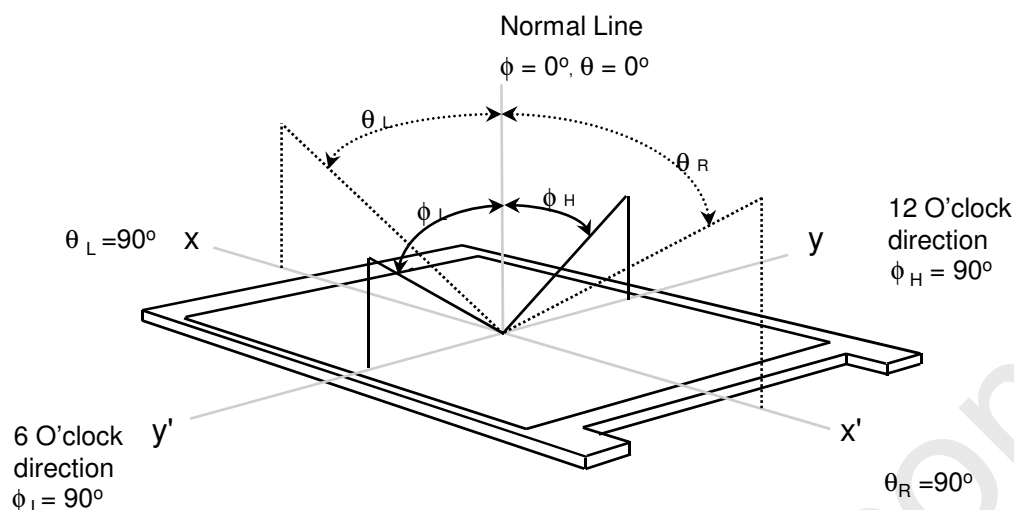
*Ta = 25 ± 2 °C, V_{DD}=3.3V,   fv= 60Hz, f_{DCLK} = 76.69 MHz, I_L = 27 mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	300	-	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T_{RT}		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		180	220	-	cd/m^2	I_L=27mA (1), (4)
Color Chromaticity (CIE)	Red	R_X		0.580	0.615	0.645	-	
		R_Y		0.327	0.355	0.385		
	Green	G_X		0.305	0.335	0.365		
		G_Y		0.580	0.610	0.640		
	Blue	B_X		0.120	0.150	0.180		
		B_Y		0.070	0.100	0.130		
	White	W_X		0.283	0.313	0.343		
		W_Y		0.299	0.329	0.359		
Viewing Angle	Hor.	θ_L	CR ≥ 10	40	-	-	Degrees	(1), (5) SR-3
		θ_R		40	-	-		
	Ver.	ϕ_H		10	-	-		
		ϕ_L		30	-	-		
Color Gamut				-	60	-	%	
13 Points White Variation		δ_L		-	-	1.7	-	(6)

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Note 1) Definition of Viewing Angle : Viewing angle range(10 ≤ C/R)

Normal Line
$\phi = 0°, \theta = 0°$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90°$ x

y

12 O'clock
direction
$\phi_H = 90°$

6 O'clock   y'
direction
$\phi_L = 90°$
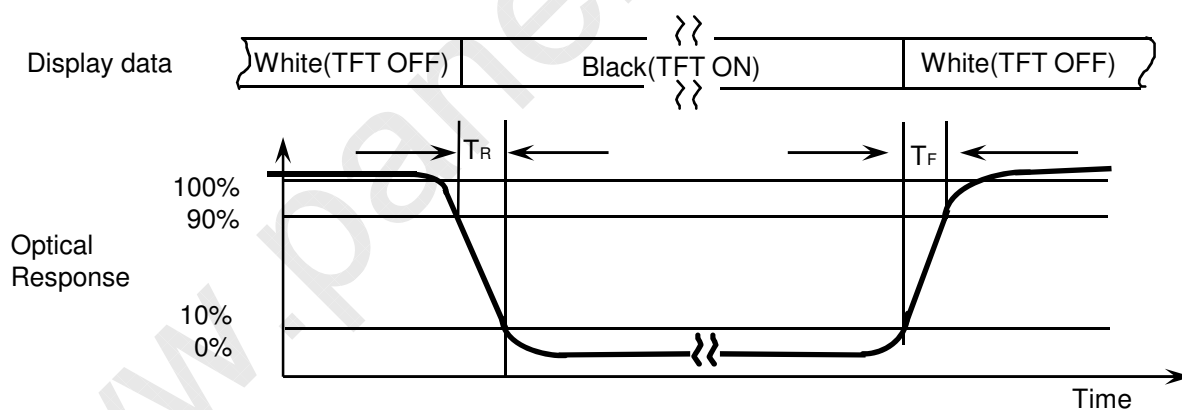
x'

$\theta_R = 90°$

Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin)
at 5 points(4, 5, 7, 9, 10)

$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : ④ , ⑤ , ⑦ , ⑨ , ⑩ at the figure of Note (6).

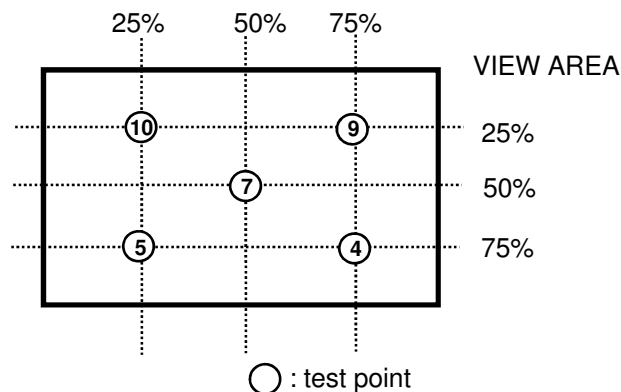Note 3) Definition of Response time :

Display data   White(TFT OFF)   Black(TFT ON)   White(TFT OFF)

T_R T_F

Optical
Response

100%
90%

10%
0%

Time

Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

25%   50%   75%

VIEW AREA

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

⑩   ⑨   25%

⑦   50%

⑤   ④   75%

○ : test point

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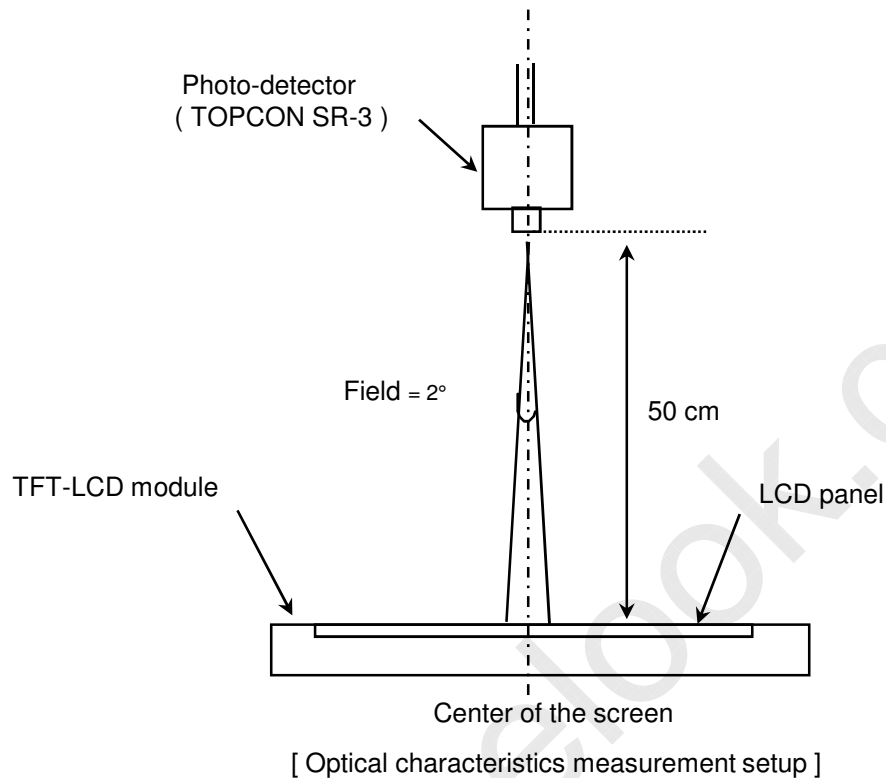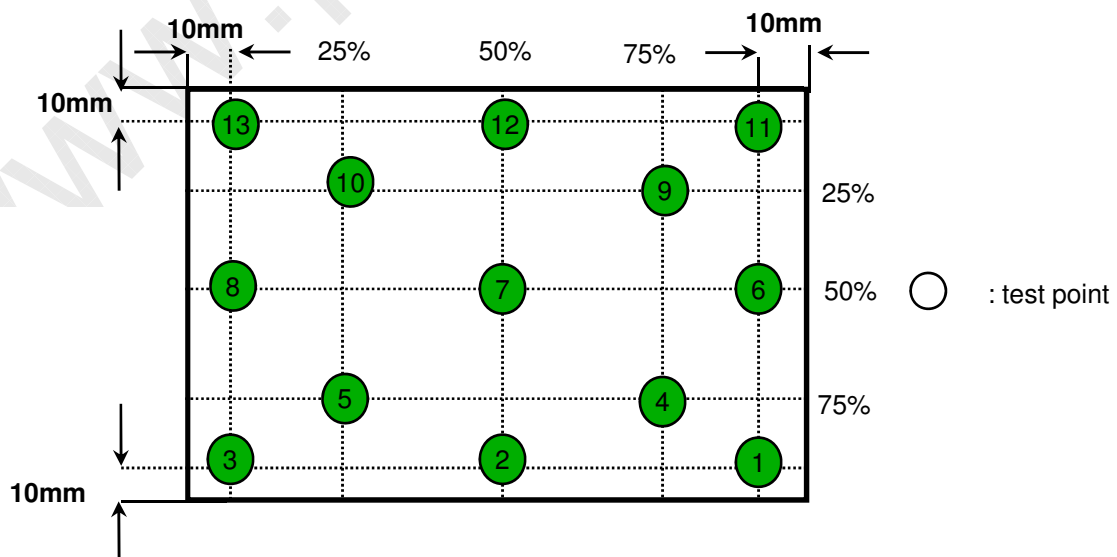| Doc.No.	LTN156AT17-W	Rev.No	04-A00-G-110621	Page	8 / 27

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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
LED current : 27 mA, Duty 100%
Environment condition : Ta = 25 ± 2 °C, Dark room, No wind, No artificial vibration

Photo-detector (TOPCON SR-3)

Field = 2°

50 cm

TFT-LCD module

LCD panel

Center of the screen

[Optical characteristics measurement setup]

Note 6) Definition of 13 points white variation (δ_L), [(1) ~ (13)]

$$\delta_L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$

10mm　　25%　　　50%　　75%　　**10mm**

10mm

13　　　12　　　11

10　　　　9　　25%

8　　　7　　　6　　50%　　◯　: test point

5　　　4　　75%

3　　　2　　　1

10mm

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= 25 ± 2°C

Item			Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply			V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold		High	V_{IH}	-	-	+100	mV	V_{CM} = +1.2V
		Low	V_{IL}	-100	-	-	mV	
Vsync Frequency			fv	-	60	-	Hz	
Hsync Frequency			f_H	-	97.08	-	KHz	
Main Frequency			f_{DCLK}	-	76.69	-	MHz	
Rush Current			I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White		I_{DD}	-	250	-	mA	(2),(3)*a
	Mosaic			-	370	424	mA	(2),(3)*b

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)
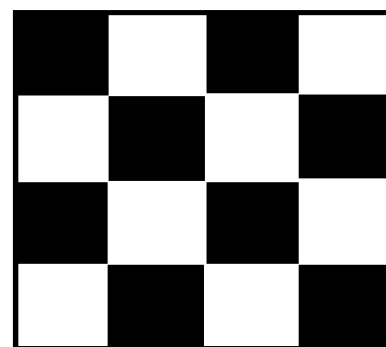
(2) f_V = 60Hz, f_{DCLK} = 76.69 MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern

VIEW AREA

*b) Mosaic Pattern

Display Brightest Gray Level

Display Darkest Gray Level
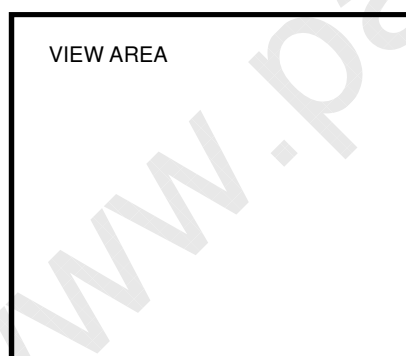
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4) Rush current measurement condition

3.3V

M1
2SK1059

FUSE

C1
1uF

V_{DD (LCD INPUT)}

R1
47K

CONTROL SIGNAL
(HIGH to LOW)

R2
1K

M2
2SK1399

12V

R3
47K

C2
10000pF

C3
1uF

V_{DD} rising time is 470us

0.9V_{DD}

3.3V

0.1V_{DD}

GND

470us

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3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	20	-	mA	
LED Forward Voltage	VF	3.0	-	3.4	V	
LED Array Voltage	VP	24	-	27.2	V	VF X 9 LEDs
Power Consumption	P	-	-	4.5	W	IF X VF X 36 LEDs (w/o Converter)

3.3 LED Driver

- LED Driver Manufacturer : Richtek

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{in}	6	12	24	V	
Input Current	I	-	108	-	mA	Max.MOSFET curent in PM6600
Output PWM Frequency	F_{PWM}	500	-	2000	kHz	No output PWM
Burst Ratio	D	10	-	100	%	PWM freq : 200Hz~10KHz
External PWM Dimming Control Frequency (BLIM)	F_{BLIM}	200Hz	-	10KHz	kHz	BLIM=PWM 0V~3.3V
Output Power	P_{out}	-	-	2.3	W	BLIM=100%

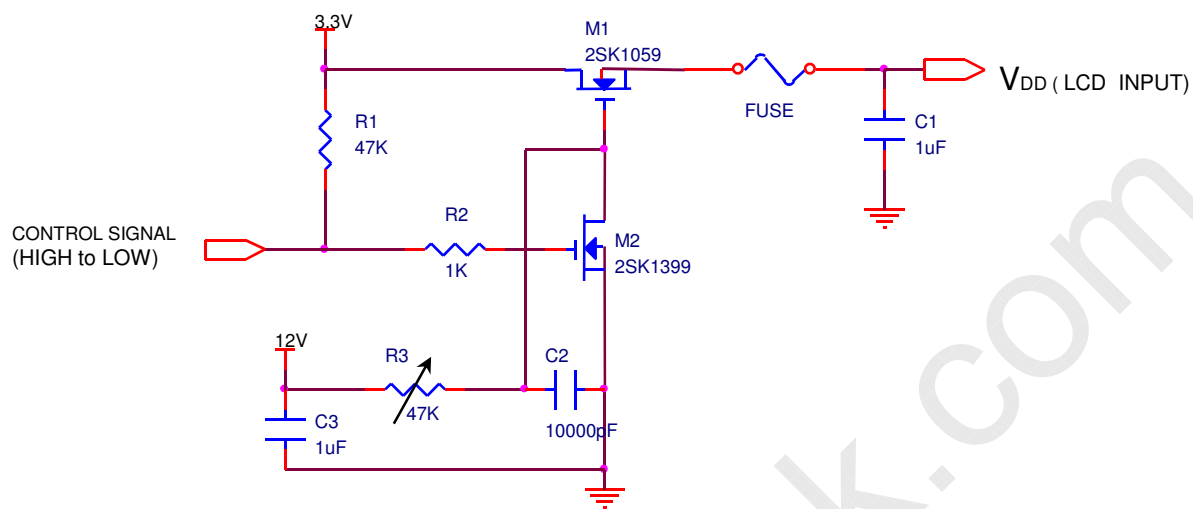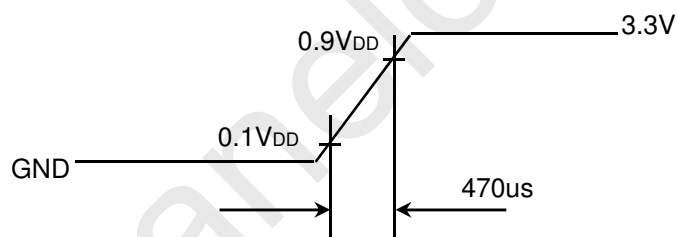Note - Test Equipment : Fluke 45

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4. BLOCK DIAGRAM

4.1 TFT LCD Module

I²C bus

EDID EEPROM

Input Connector
I-PEX 20455-040E

LVDS

LVDS Input/LCDS Output Timing Controller

LCDS

DC-DC Converter VCOM Generator

Gamma Generator

Source Driver IC

15.6" HD TFT-LCD Panel

TFT on Glass

SOURCE PCB

- → Video Signal
- → Control Signal
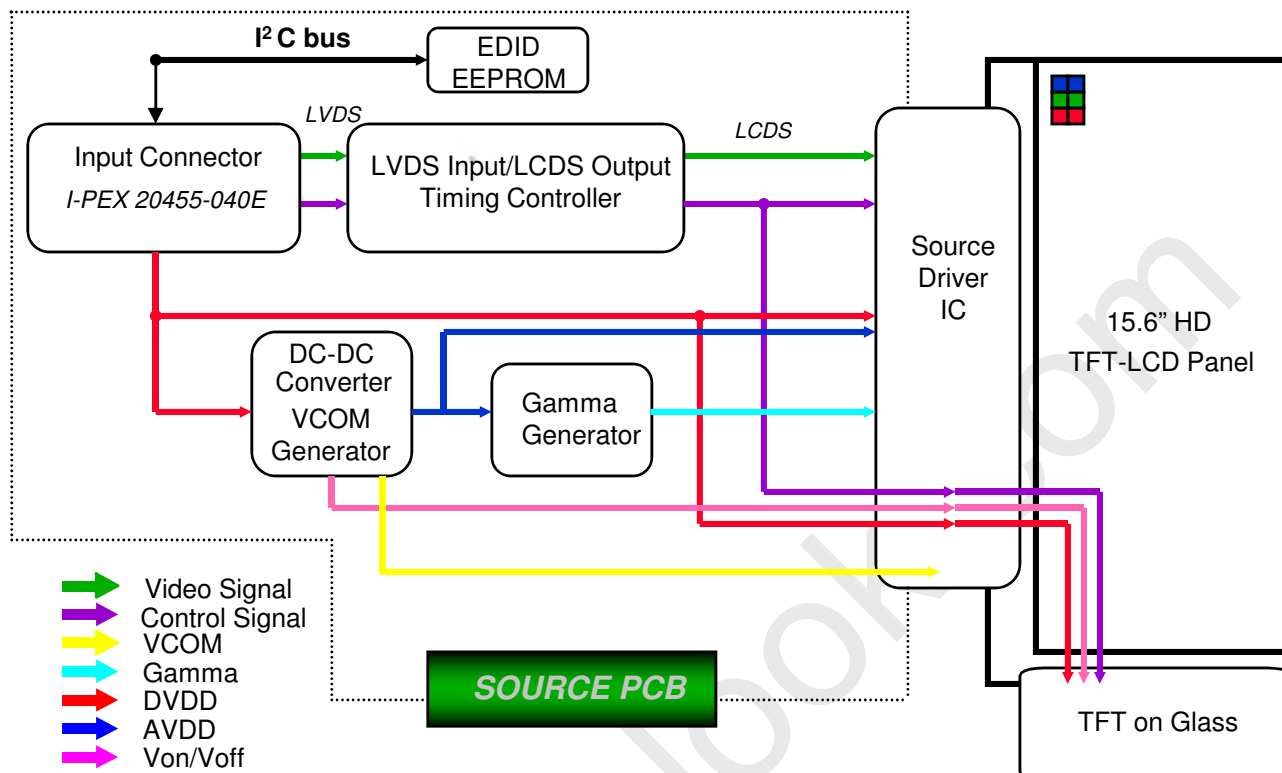- → VCOM
- → Gamma
- → DVDD
- → AVDD
- → Von/Voff

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LED Placement

LED#1 Channel 1 · LED#1 Channel 2 · LED#1 Channel 3 · LED#1 Channel 4 · LED#2 Channel 1 · LED#2 Channel 2 · LED#2 Channel 3 · LED#2 Channel 4 · … · LED#98Channel 1 · LED#8 Channel 2 · LED#8 Channel 3 · LED#8 Channel 4 · LED#9 Channel 1 · LED#9 Channel 2 · LED#9 Channel 3 · LED#9 Channel 4
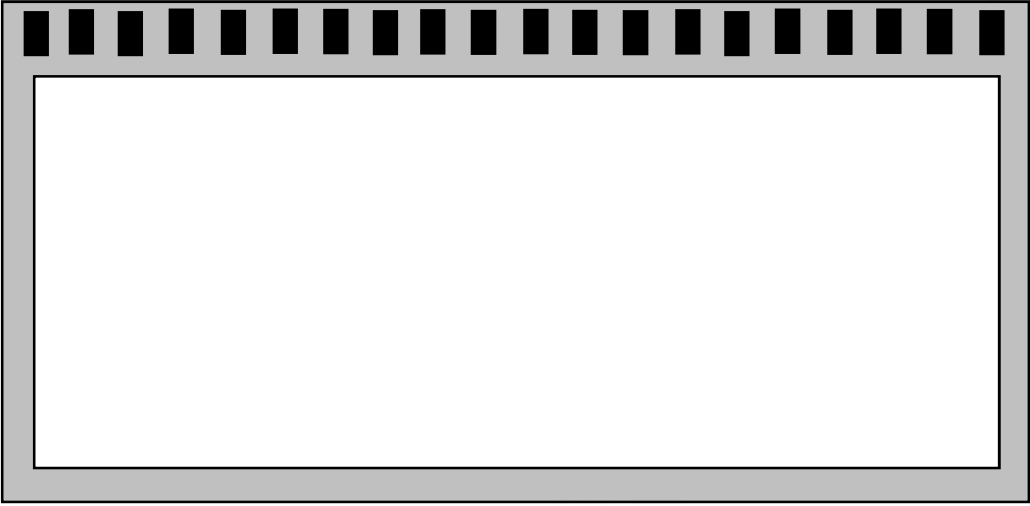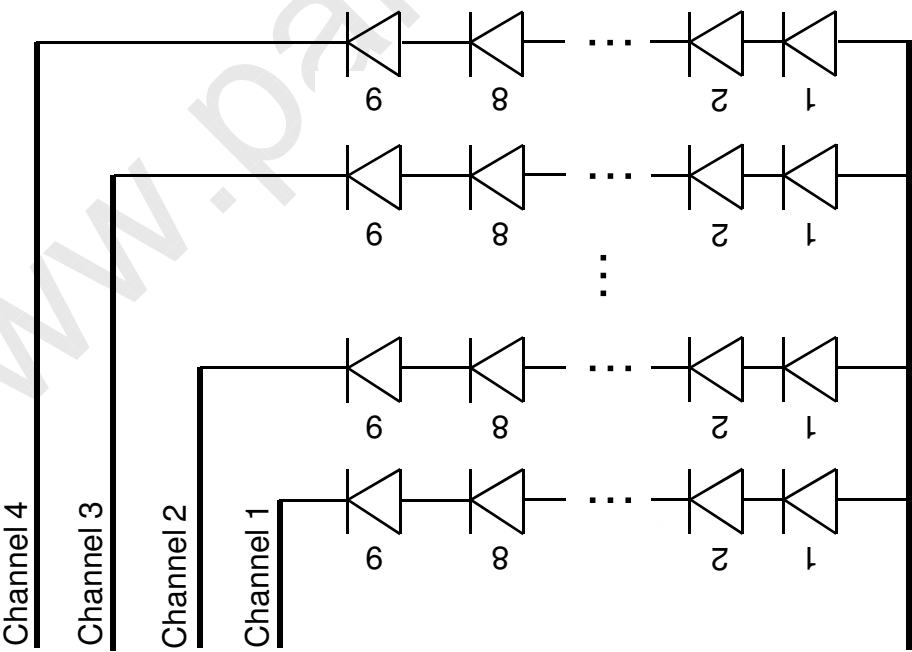
LED Wiring

4. BLOCK DIAGRAM

4.2 LED connection and placement

Channel 4 · Channel 3 · Channel 2 · Channel 1 · LED Power

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E)

PIN #	Symbol	Description
1	NC	No connection
2	VDD	Power Supply, 3.3 V (typical)
3	VDD	Power Supply, 3.3 V (typical)
4	V EEDID	DDC 3.3V power
5	NC	No connection
6	Clk EEDID	DDC Clock
7	DATA EEDID	DDC Data
8	Odd_Rin0-	- LVDS differential data input (R0-R5, G0) (odd pixels)
9	Odd_Rin0+	+ LVDS differential data input (R0-R5, G0) (odd pixels)
10	VSS	Ground – Shield
11	Odd_Rin1-	- LVDS differential data input (G1-G5, B0-B1) (odd pixels)
12	Odd_Rin1+	+ LVDS differential data input (G1-G5, B0-B1) (odd pixels)
13	VSS	Ground – Shield
14	Odd_Rin2-	- LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels)
15	Odd_Rin2+	+ LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels)
16	VSS	Ground – Shield
17	Odd_ClkIN-	- LVDS differential clock input (odd pixels)
18	Odd_ClkIN+	+ LVDS differential clock input (odd pixels)
19	NC	No connection
20	NC	No connection
21	NC	No connection
22	NC	No connection
23	NC	No connection
24	NC	No connection
25	NC	No connection

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E)

PIN #	Symbol	Description
26	NC	No connection
27	NC	No connection
28	NC	No connection
29	NC	No connection
30	NC	No connection
31	VSSLED	Ground – LED
32	VSSLED	Ground – LED
33	VSSLED	Ground – LED
34	NC	No connection
35	PWM	System PWM Signal Input (+3.3V Swing)
36	LED_EN	LED enable pin (+3.3V Input)
37	NC	NC
38	VDDLED	7.5V – 21V LED power
39	VDDLED	7.5V – 21V LED power
40	VDDLED	7.5V – 21V LED power

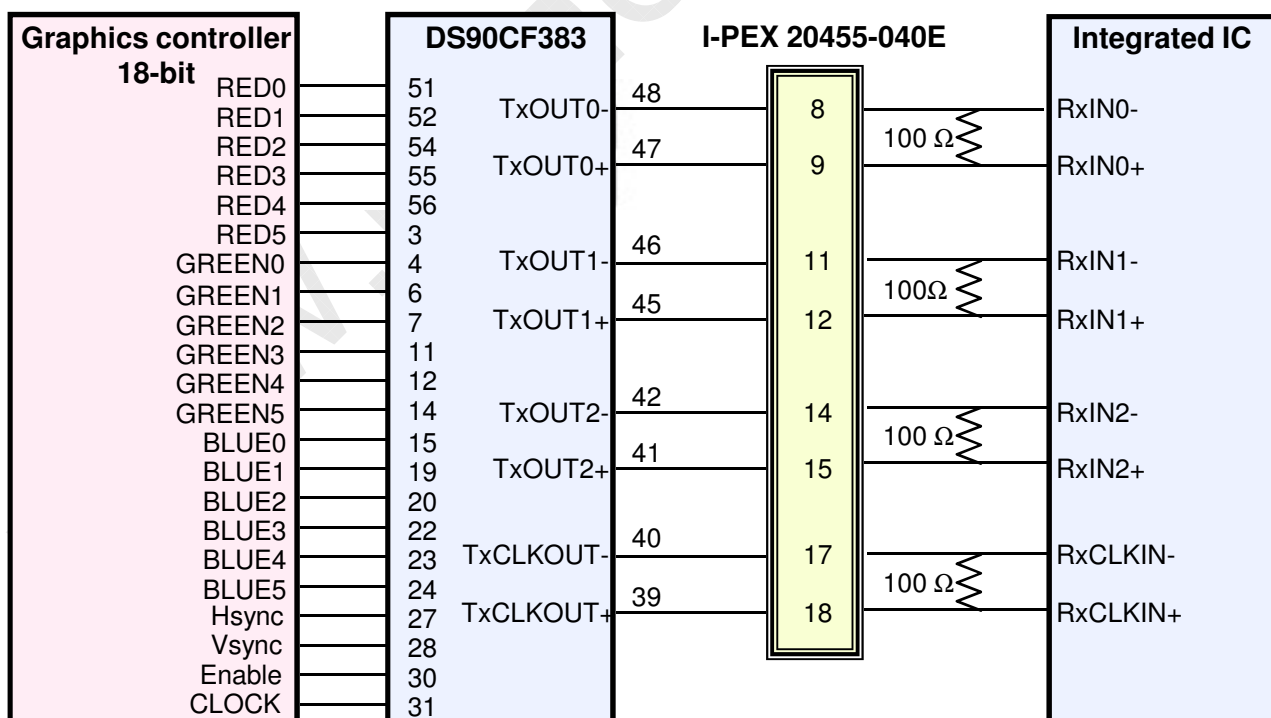**Samsung Secret**

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5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
51	TxIN0	R0	14	TxIN14	G5
52	TxIN1	R1	15	TxIN15	B0
54	TxIN2	R2	19	TxIN18	B1
55	TxIN3	R3	20	TxIN19	B2
56	TxIN4	R4	22	TxIN20	B3
3	TxIN6	R5	23	TxIN21	B4
4	TxIN7	G0	24	TxIN22	B5
6	TxIN8	G1	27	TxIN24	Hsync
7	TxIN9	G2	28	TxIN25	Vsync
11	TxIN12	G3	30	TxIN26	DE
12	TxIN13	G4	31	TxCLKIN	Clock

LVDS INTERFACE

Graphics controller 18-bit	DS90CF383	I-PEX 20455-040E	Integrated IC
RED0 51			
RED1 52	TxOUT0- 48	8	RxIN0-
RED2 54	TxOUT0+ 47	9	100 Ω RxIN0+
RED3 55			
RED4 56			
RED5 3	TxOUT1- 46	11	RxIN1-
GREEN0 4	TxOUT1+ 45	12	100Ω RxIN1+
GREEN1 6			
GREEN2 7			
GREEN3 11			
GREEN4 12	TxOUT2- 42	14	RxIN2-
GREEN5 14	TxOUT2+ 41	15	100 Ω RxIN2+
BLUE0 15			
BLUE1 19			
BLUE2 20	TxCLKOUT- 40	17	RxCLKIN-
BLUE3 22	TxCLKOUT+ 39	18	100 Ω RxCLKIN+
BLUE4 23			
BLUE5 24			
Hsync 27			
Vsync 28			
Enable 30			
CLOCK 31			

Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.
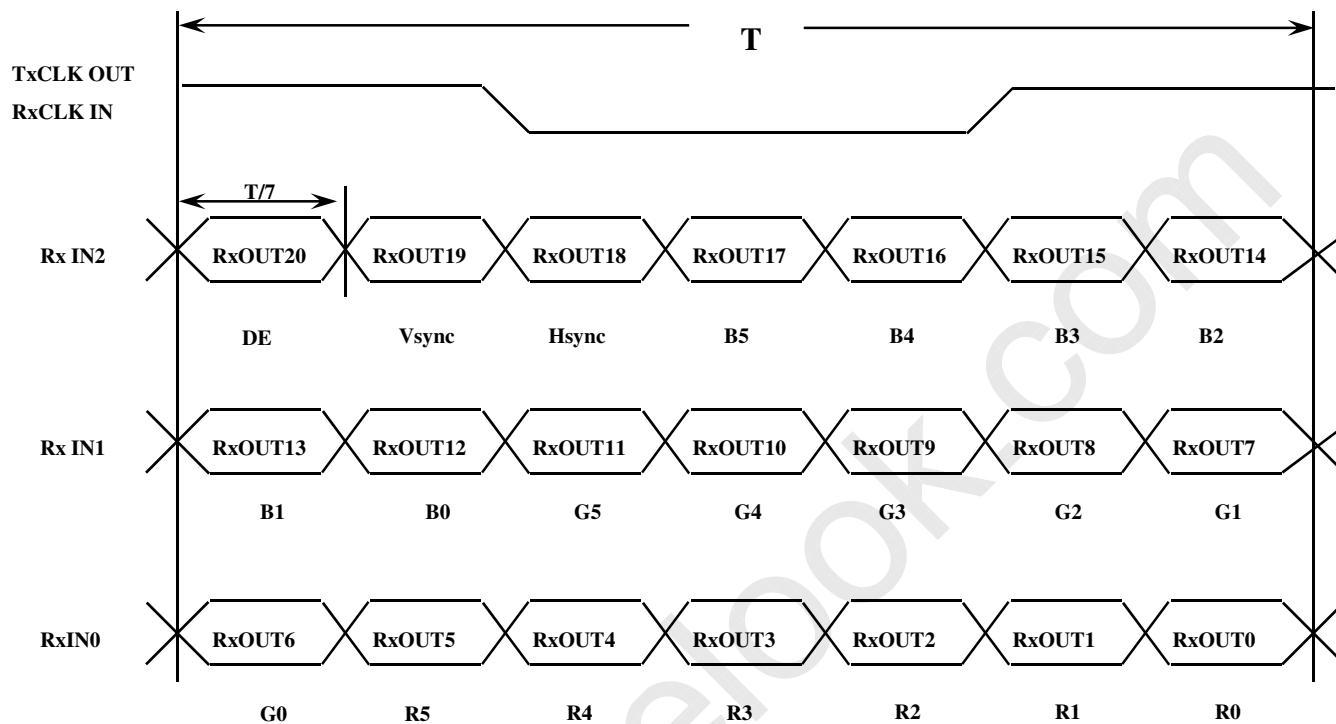
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5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON

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5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

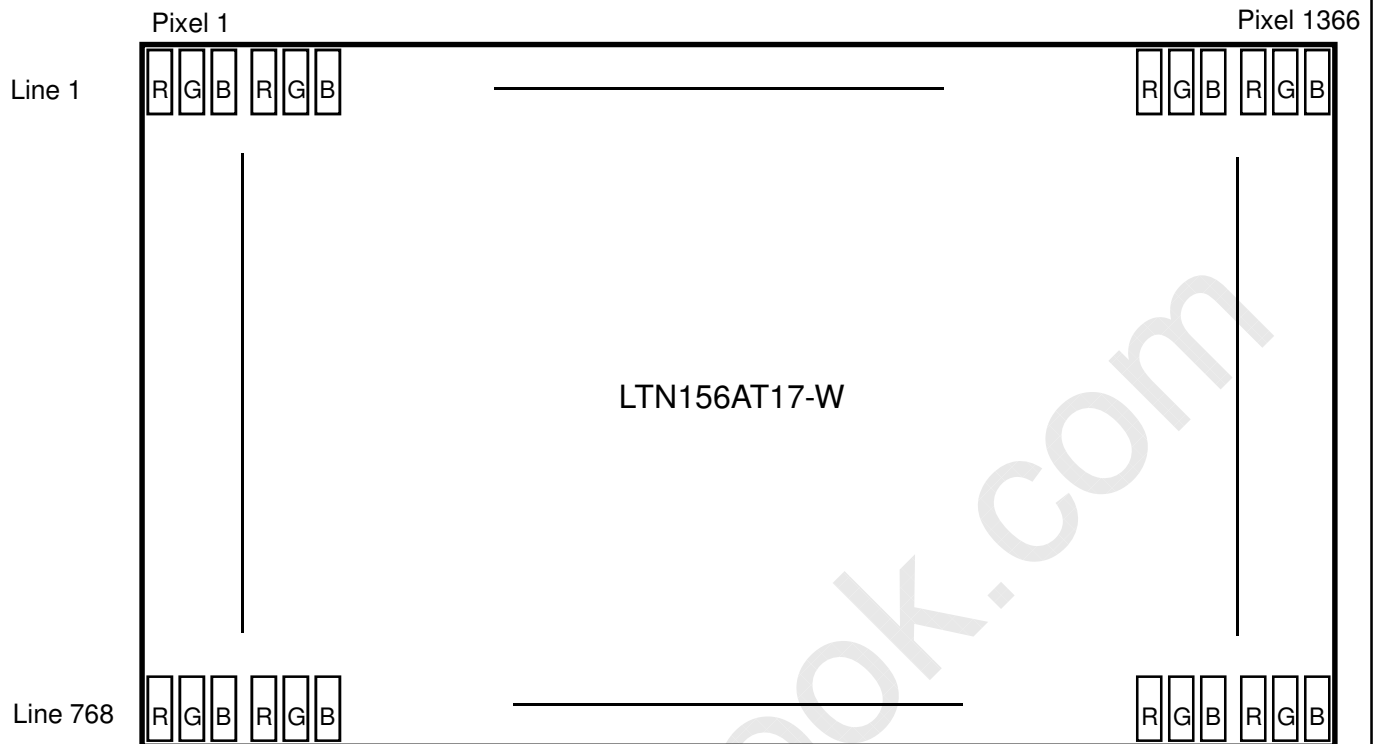| Color	Display	Data Signal																		Gray Scale Level
		Red						Green						Blue						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	45	B5	
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
Gray Scale Of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	Dark	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
Gray Scale Of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
Gray Scale Of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :
　　　Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)
Note 2)Input signal: 0 =Low level voltage, 1=High level voltage

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5.5 Pixel Format in the display

Pixel 1

Pixel 1366

Line 1

R G B　R G B

R G B　R G B

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Line 768

R G B　R G B

R G B　R G B

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6. INTERFACE TIMING

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6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	-	790	-	Lines	-
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	-
One Line Scanning Time	Cycle	TH	-	1586	-	Clocks	-
Horizontal Active Display Term	Display Period	THD	-	1366	-	Clocks	-

6.2 Timing diagrams of interface signal

DE

DCLK

DE

DATA SIGNALS — Valid display data (1366 clocks)
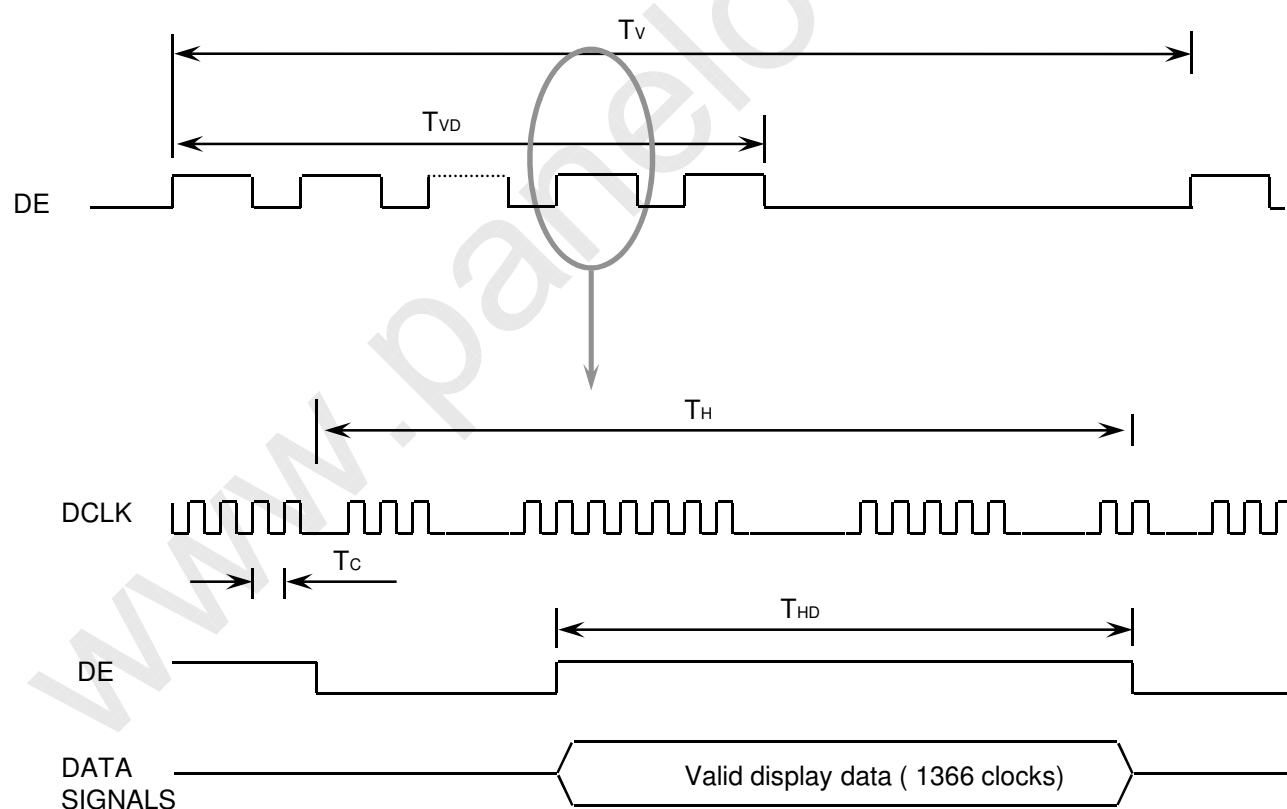
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6.3 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.
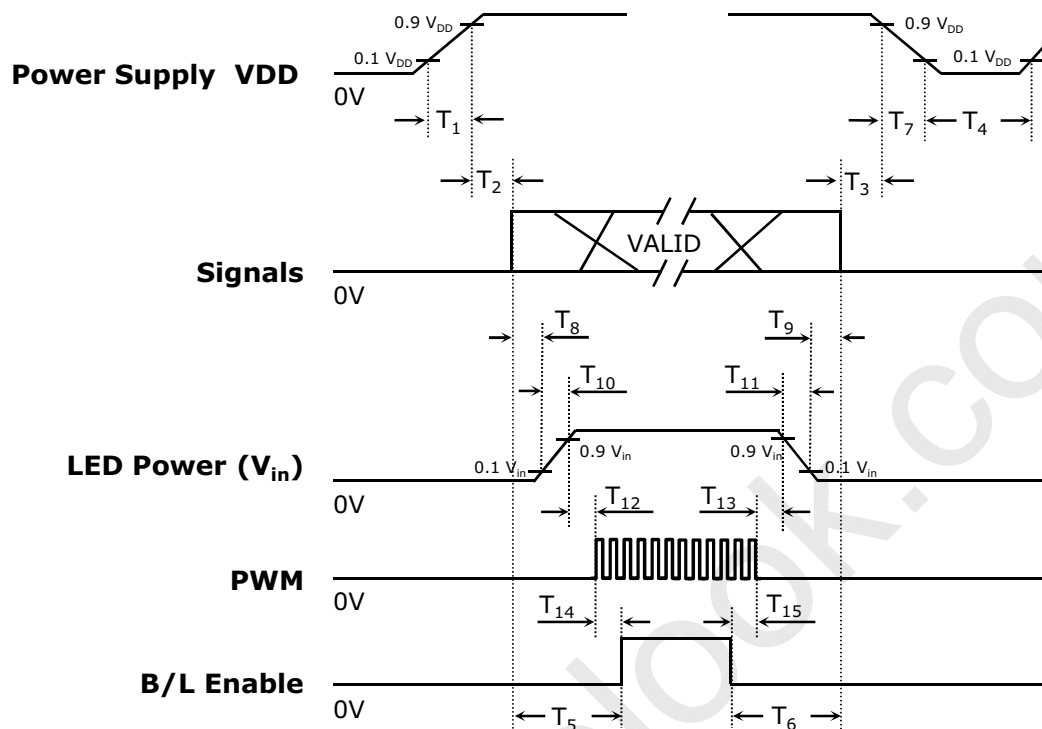
| Timing (ms)	Remarks
$0.5 < T_1 \leq 10$	V_{DD} rising time from 10% to 90%
$0 < T_2 \leq 50$	Delay from V_{DD} to valid data at power ON
$0 < T_3 \leq 50$	Delay from valid data OFF to V_{DD} OFF at power Off
$500 \leq T_4$	V_{DD} OFF time for Windows restart
$200 \leq T_5$	Delay from valid data to B/L enable at power ON
$200 \leq T_6$	Delay from valid data off to B/L disable at power Off
$0 < T_7 \leq 10$	V_{DD} falling time from 90% to 10%
$10 < T_8$	Delay from valid data on to LED driver Vin rising time 10%
$10 < T_9$	Delay from LED driver Vin falling time 10% to valid data Off
$0.5 < T_{10} \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T_{11} \leq 10$	LED V_{in} falling time from 90% to 10%
$10 < T_{12}$	Delay from LED driver Vin rising time 90% to PWM ON
$10 < T_{13}$	Delay from PWM Off to LED driver Vin falling time 10%
$10 < T_{14}$	Delay from PWM ON to B/L Enable ON
$10 < T_{15}$	Delay from B/L Enable Off to PWM Off

Note : Backlight may flash if interface signal remains floating state at invalid period.

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7. MECHANICAL OUTLINE DIMENSION

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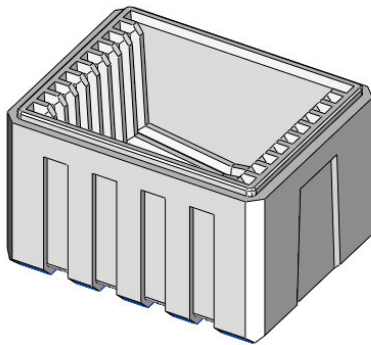| Doc.No.	LTN156AT17-W	Rev.No	04-A00-G-110621	Page	23 / 27
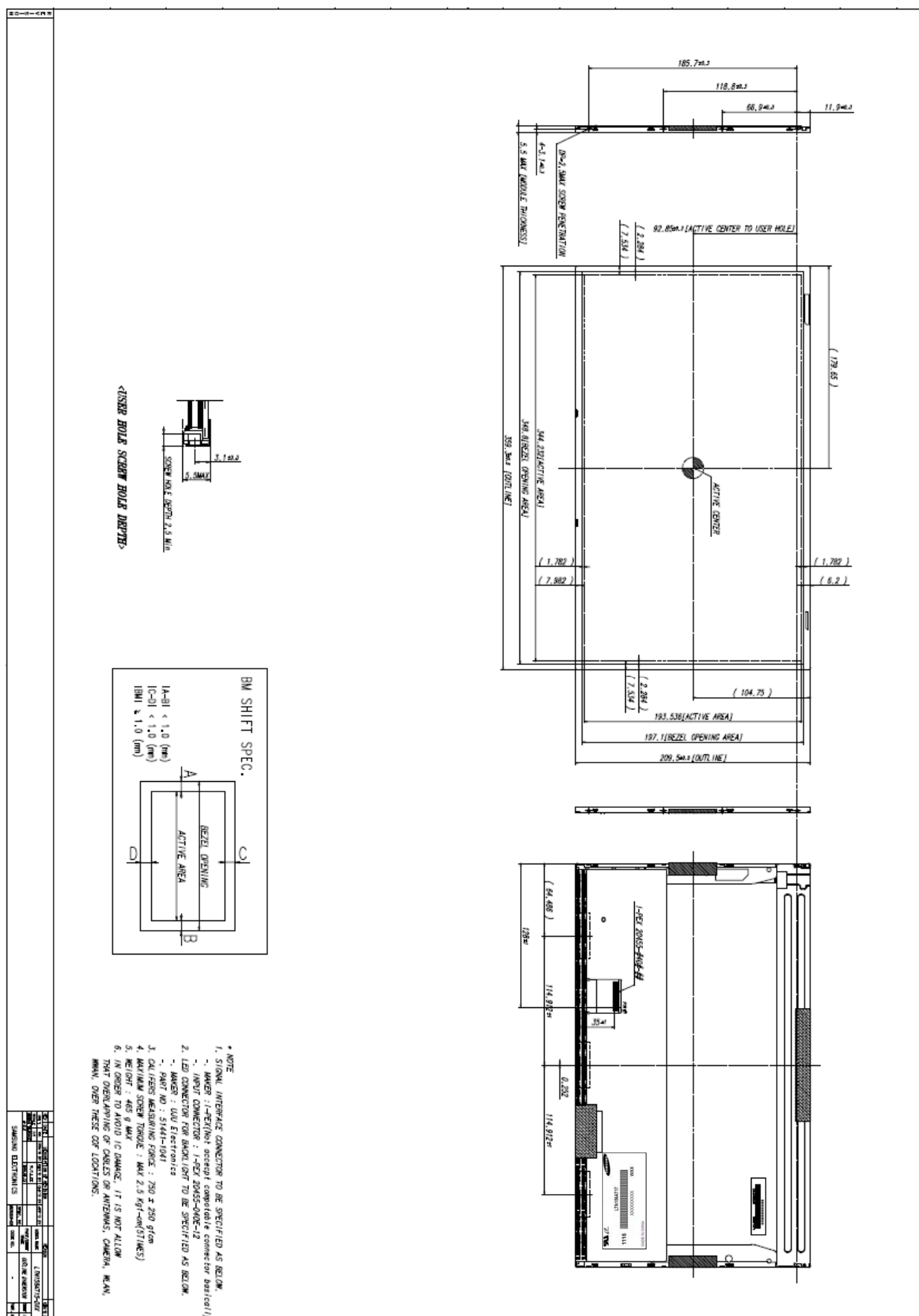
8. PACKING

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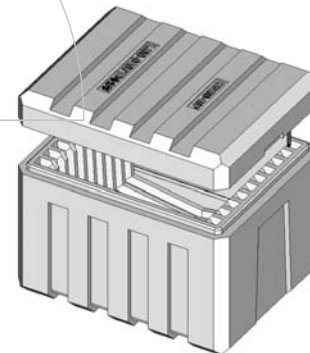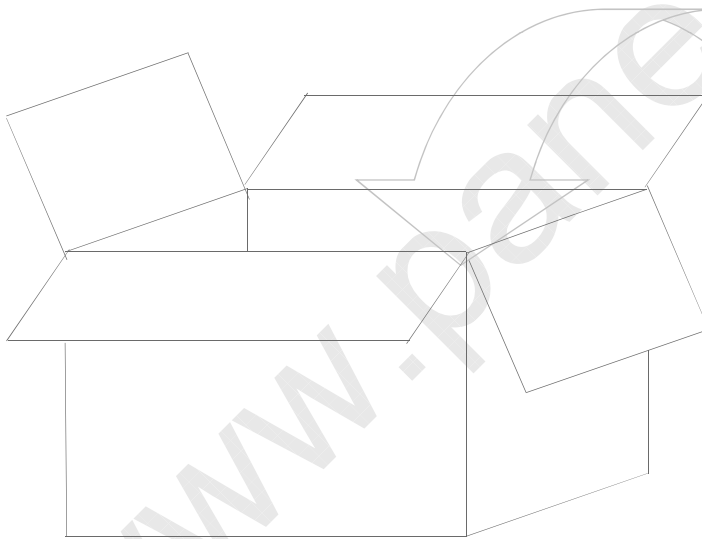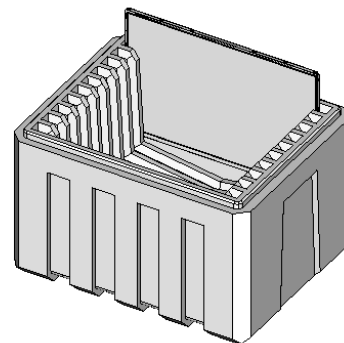1. CARTON(Internal Package)

   (1) Packing Form
     Corrugated Cardboard box and Corrupad form as shock absorber

   (2) Packing Method

| CUSHION BOTTOM | PANEL : 2EA/SLIT |

CUSHION TOP, BOTTOM

Note (1) Total : Approx. 12400 g

      (2) Acceptance number of piling : 20 sets

      (3) Carton size : 359(W) X 463(D) X 333(H)

      (4) MAX accumulation quantity : 5 cartons

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Global LCD Panel Exchange Center   www.panelook.com   屏库:全球液晶屏交易中心

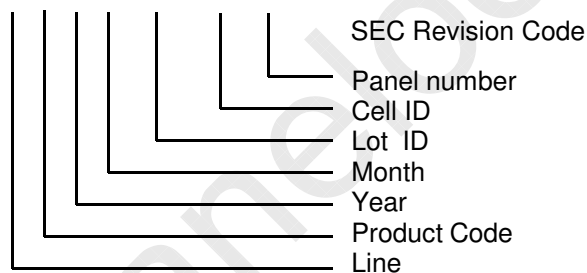| No	Part name	Quantity
1	Static electric protective sack	20
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

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9. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

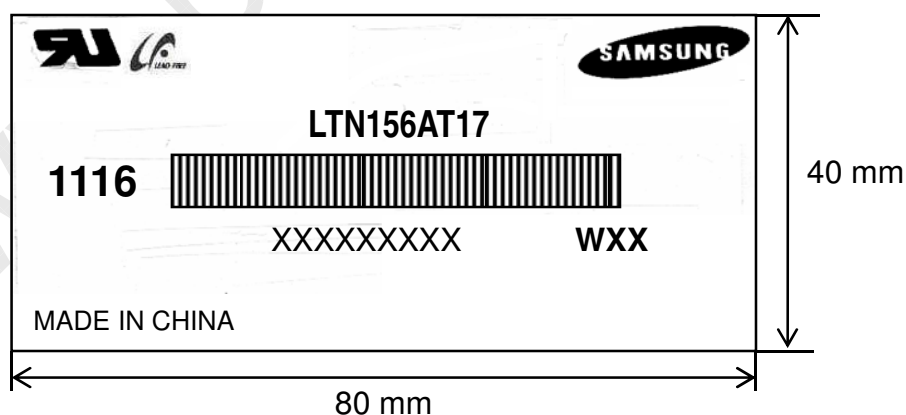(1)Parts number : LTN156AT17
(2)Revision code : 3 letters
(3)Lot number   : X X X X   XX XX XX   WXX

SEC Revision Code
Panel number
Cell ID
Lot ID
Month
Year
Product Code
Line

(4) Nameplate Indication

LTN156AT17

1116

XXXXXXXXX   **WXX**

MADE IN CHINA

40 mm

80 mm

Parts name   : LTN156AT17
Lot number   : XXXXXXXXXX
Inspected work week   : 1116(2011 year 16th week)
Product Revision Code : WXX

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One step solution for LCD / PDP / OLED panel application: Datasheet, inventory and accessory! www.panelook.com

10. GENERAL PRECAUTIONS

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1. Handling

(a) When the module is assembled, It should be attached to the system firmly
    using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to
    damage, this may cause improper operation or damage to the module.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch
    the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time,
    Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane.
    Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl
    chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or
    mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly
    with soap.

(h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

(i) Use fingerstalls with soft gloves in order to keep display clean during the incoming
    inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not adjust the variable resistor which is located on the back side.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so
    that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

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2. STORAGE

(a) Do not leave the module in high temperature, and high humidity for a long time.
　　It is highly recommended to store the module with temperature from 0 to 35 °C and
　　relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent
　　light during the store.

3. OPERATION

(a) Do not connect,disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3
　　 " Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic
　　 interference shall be done by system manufacturers. Grounding and shielding methods
　　 may be important to minimize the interference.

(d) The standard limited warranty is only applicable when the module is used for general
　　 notebook applications. If used for purposes other than as specified, SEC is not to be
　　 held reliable for the defective operations. It is strongly recommended to contact SEC
　　 to find out fitness for a particular purpose.

4. OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection
　　of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input
　　voltage variation, variation in part contents and environmental temperature, so on)
　　Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time,it can be
　　the situation when the image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in
　　order not to be stressed.

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